

CXA3840WR

Description

CXA3840WR is the power management IC for security camera system.

CXA3840WR has the optimized configuration for CCTV security camera system with CCD image sensor. The basic power stages required in CCTV security camera can be formed by CXA3840WR without any other ICs.

Features

- ◆ Wide input voltage range : 7 V to 25 V
- ◆ Multiple output power supply for CCTV security camera system
 - Switching Regulator : 1 ch
 - Internal MOSFET switch
 - 1 MHz High switching frequency
 - LDO Regulator : 5 ch
 - Charge pump driver : 2 ch
 - Voltage monitor : 2 ch (output)
 - Output sequence control
 - secure DSP&AFE&CCD operation
- ◆ Thermal shut down
- ◆ Over current protections

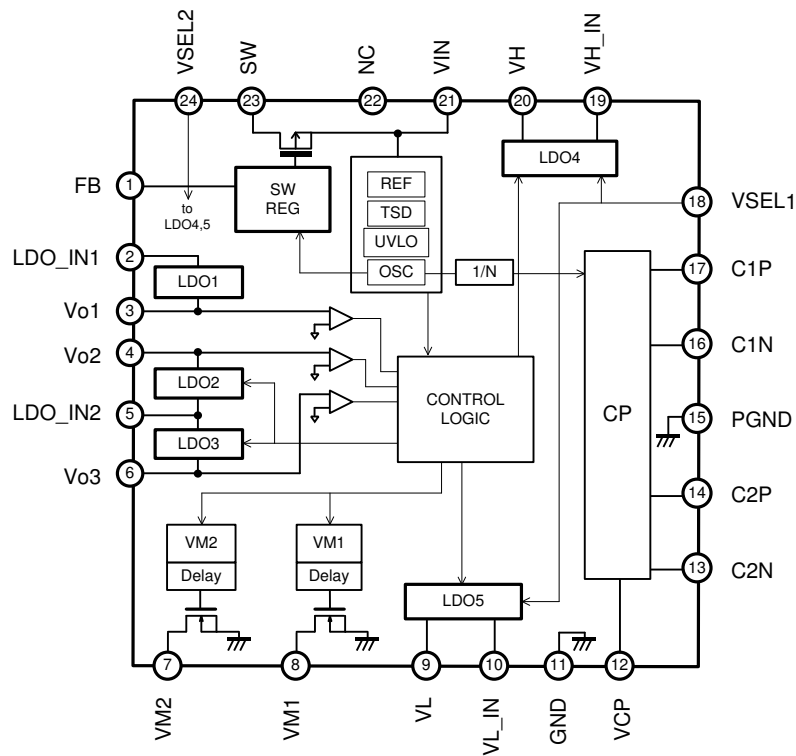
Package

QFN 24 pin (4 mm × 4 mm)

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Block Diagram



Absolute Maximum Ratings

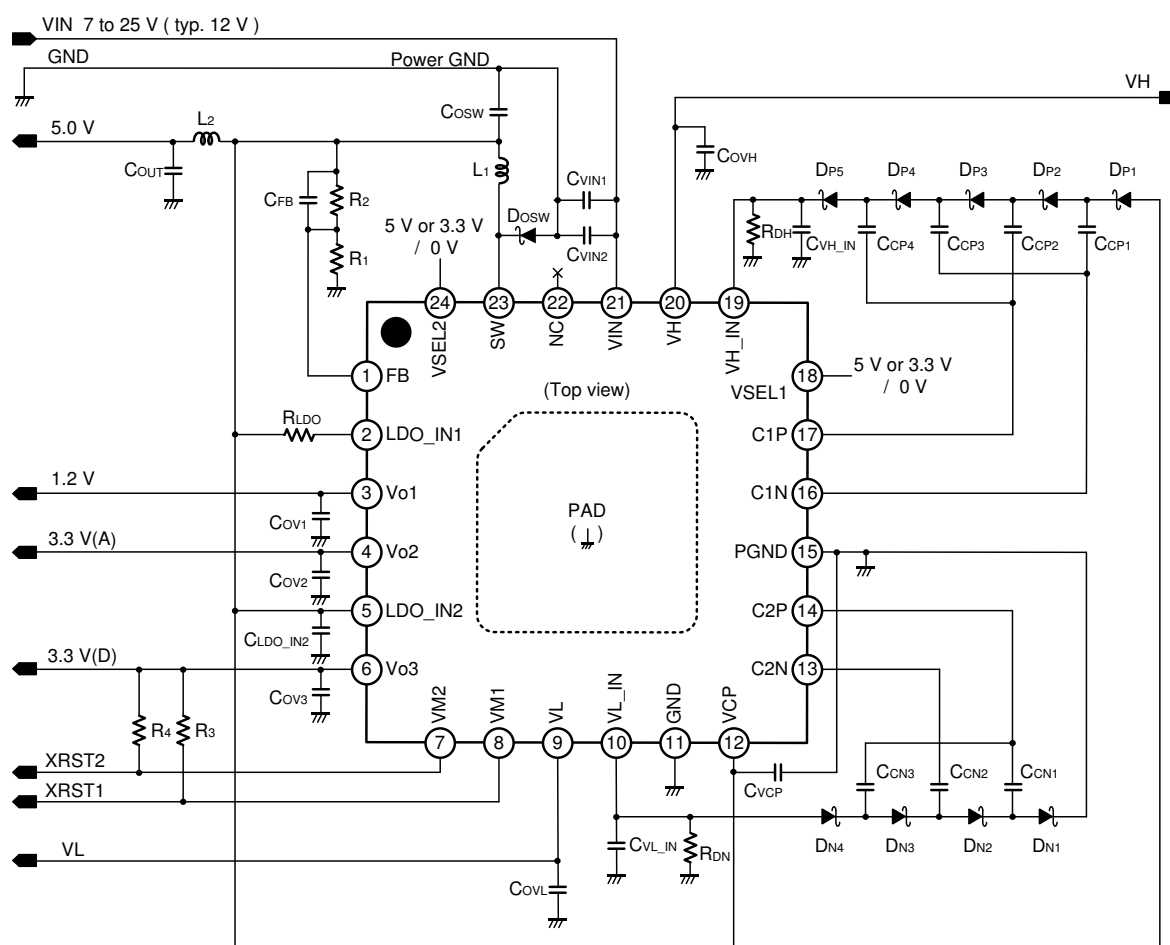
Parameters	Symbol	Maximum Ratings	Unit
Power Supply Voltage	V _{VIN}	- 0.3 to 28	V
Feedback Voltage	V _{FB}	- 0.3 to 6	V
LDO_IN1 Voltage	V _{LDO_IN1}	- 0.3 to 6	V
LDO_IN2 Voltage	V _{LDO_IN2}	- 0.3 to 6	V
Vo1 Voltage	V _{Vo1}	- 0.3 to 6	V
Vo2 Voltage	V _{Vo2}	- 0.3 to 6	V
Vo3 Voltage	V _{Vo3}	- 0.3 to 6	V
VM1 Voltage	V _{VM1}	- 0.3 to 6	V
VM2 Voltage	V _{VM2}	- 0.3 to 6	V
VL_IN Voltage	V _{VL_IN}	- 17 to 0.3	V
VL Voltage	V _{VL}	- 10 to 0.3	V
VCP Voltage	V _{VCP}	- 0.3 to 6	V
C1P Voltage	V _{C1P}	- 0.3 to 6	V
C2P Voltage	V _{C2P}	- 0.3 to 6	V
C1N Voltage	V _{C1N}	- 0.3 to 6	V
C2N Voltage	V _{C2N}	- 0.3 to 6	V
VSEL1 Voltage	V _{VSEL1}	- 0.3 to 6	V
VSEL2 Voltage	V _{VSEL2}	- 0.3 to 6	V
VH_IN Voltage	V _{VH_IN}	- 0.3 to 28	V
VH Voltage	V _{VH}	- 0.3 to 17	V
SW terminal Voltage	V _{sw}	- 0.3 to 30	V
Power Dissipation *1	PD	2100 *1	mW
Operation Temperature	T _a	- 20 to +75	°C
Junction Temperature	T _j	- 40 to +150	°C
Storage Temperature	T _{stg}	- 40 to +150	°C

*1 FR-4 114.3 mm × 76.2 mm × 1.6 mm 4 layer : EIA/JEDEC

Recommended Operating Conditions

Parameter	Symbol	Min.	Typ.	Max.	Unit
Power Supply Voltage	VIN	7	12	25	V
SW Inductor	L1	3.9	10	18	μH
SW Output Capacitor	Cosw	22	47	100	μF
Phase Compensate Capacitor	C _{FB}	24	27	30	pF
SW Feedback Resister1	R1	30	33	36	k Ω
SW Feedback Resister2	R2	135	150	165	k Ω
LDO1 Output Capacitor	Cov1	10	22	—	μF
LDO2 Output Capacitor	Cov2	6.8	10	—	μF
LDO3 Output Capacitor	Cov3	6.8	10	—	μF
LDO4 Output Capacitor	CovH	1	2.2	—	μF
LDO5 Output Capacitor	CovL	1	2.2	—	μF

Typical Application



Electrical Characteristics

Ta = 25 °C, VVIN = 12 V unless otherwise noted.

1. Current Consumption (VIN)

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Current Consumption	IQ	VIN = 12 V, FB = 0.7 V, VCP = VLDO_IN1 = VLDO_IN2 = 5 V VVH_IN = 22 V, VVL_IN = -13 V VO1 to VO3, VH, VL = no load CCP1 to 5, CCN1 to 4 = no load IQ = IVIN+ IVCp+ ILDO_IN1+ ILDO_IN2+ IVH_IN+ IVL_IN	—	6	10	mA

2. Charge Pump Circuit

VVCP = 5 V, fTCP = 31 kHz, CCP1 to 5, CVH_IN, CCN1 to 4, CVL_IN = 10 µF, SBD:CRS03 or equivalent, unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
UVLO Release Voltage	VT_ON_CP	VVCP L→H	2.8	3.3	3.8	V
UVLO Detect Voltage	VT_OFF_CP	VVCP H→L	2.6	3.1	3.6	V
High-side Transistor On Resistance	RDSH	IOCP, IOC2P, IOC1N, IOC2N = -100 mA	0.5	1	2	Ω
Low-side Transistor On Resistance	RDSL	IOC1P, IOC2P, IOC1N, IOC2N = 100 mA	0.5	1	2	Ω
Timing Frequency	fTCP	No load	27	31	35	kHz
Soft Start Time	Tss_cp	—	—	70	—	ms
Output Impedance	$\Delta V_{VH_IN}/\Delta I_{O_CH}$	IO_CP = 10 to 20 mA	—	60	—	V/A
	$\Delta V_{VL_IN}/\Delta I_{O_CN}$	IO_CN = 10 to 20 mA	—	45	—	V/A
Output Voltage	VVH_IN	IO_CP = 40 mA	—	22	—	V
	VVL_IN	IO_CN = 30 mA,	—	- 13	—	V

3. Switching Regulator

Ta = 25 °C, V_{VIN} = 12 V unless otherwise noted.

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
[UVLO]						
UVLO Release Voltage	V _{T_ON}	V _{VIN} = L → H	6.4	6.6	6.8	V
UVLO Detect Voltage	V _{T_OFF}	V _{VIN} = H → L	6.15	6.35	6.55	V
Hysteresis	V _{HYS}	—	200	250	—	mV
[Soft Start]						
Soft Start Time	T _{SS}	V _{FB} = 0.85 V	2	4	8	ms
[Oscillator]						
Switching Frequency1	f _{OSC}	V _{FB} = 0.8 V	900	1000	1100	kHz
Switching Frequency2	f _{OSC_LOW}	V _{FB} = 0.4 V	290	333	450	kHz
Frequency variability (V _{VIN})	f _{ΔV}	V _{VIN} = 7 to 25 V	—	1	—	%
Frequency variability (Temp.)	f _{ΔT}	Ta = -20 to +75 °C	—	5	—	%
[Error Amplifier]						
Reference Voltage	V _B	—	- 3.0 %	0.9	+ 3.0 %	V
Input Bias Current	I _B	—	-0.1	—	0.1	μA
V _B Output Voltage Line Regulation	ΔV _B	V _{VIN} = 7 to 25 V	—	0.2	—	mV
V _B Output Voltage Temperature Coefficient	ΔV _B / Ta	Ta = -20 to +75 °C	—	±50	—	p-pm/°C
[PWM Comparator]						
Maximum Duty Cycle	MaxDuty	V _{FB} = 0.8 V	85	90	—	%
Minimum On Time	t _{ON_min}	—	—	150	190	ns
[SW Output]						
Output On Resistance	R _{ON}	I _{SW} = 1 A	—	0.45	0.7	Ω
SW Current Limitation	I _{LIM}	—	1.6	2.0	2.4	A
SW Leak Current	I _{LEAK}	V _{VIN} = 28 V, V _{SW} = 0 V	—	—	1	μA
[Thermal Shut Down]						
Thermal Shut Down Detection Temperature	T _{TSD}	—	—	168	—	°C
Thermal Shut Down Release Temperature	T _{TSR}	—	—	155	—	°C

4. LDO 1

$V_{LDO_IN1} = V_{LDO_IN2} = 5\text{ V}$

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{O1}	$I_{O1} = 200\text{ mA}$	- 2.0 %	1.2	+ 2.0 %	V
Output Current	I_{O1}	$V_{O1} \times 0.9$	400	800	—	mA
Load Regulation	$\Delta V_{O1} / I_{O1}$	$I_{O1} = 1\text{ to }400\text{ mA}$	—	0.0025	0.0075	%/mA
Ripple Rejection	RR1	$E_{in} = 50\text{ mVrms}$, $f = 1\text{ kHz}$, $I_{O1} = 200\text{ mA}$	—	45	—	dB
Dropout Voltage	ΔV_{IO1}	$I_{O1} = 400\text{ mA}$	—	0.4	0.8	V
Output Voltage Temperature Coefficient	$\Delta V_{O1} / T_a$	$T_a = -20\text{ to }+75\text{ }^\circ\text{C}$, $I_{O1} = 200\text{ mA}$	—	± 50	—	p-pm/ °C

5. LDO 2

$V_{LDO_IN1} = V_{LDO_IN2} = 5\text{ V}$

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{O2}	$I_{O2} = 100\text{ mA}$	- 1.5 %	3.3	+ 1.5 %	V
Output Current	I_{O2}	$V_{O2} \times 0.9$	150	300	—	mA
Load Regulation	$\Delta V_{O2} / I_{O2}$	$I_{O2} = 1\text{ to }150\text{ mA}$	—	0.005	0.014	%/mA
Ripple Rejection	RR2	$E_{in} = 50\text{ mVrms}$, $f = 1\text{ kHz}$, $I_{O2} = 100\text{ mA}$	—	45	—	dB
Dropout Voltage	ΔV_{IO2}	$I_{O2} = 150\text{ mA}$	—	0.4	0.8	V
Output Voltage Temperature Coefficient	$\Delta V_{O2} / T_a$	$T_a = -20\text{ to }+75\text{ }^\circ\text{C}$ / $I_{O2} = 100\text{ mA}$	—	± 50	—	p-pm/ °C

6. LDO 3

$V_{LDO_IN1} = V_{LDO_IN2} = 5\text{ V}$

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V_{O3}	$I_{O3} = 150\text{ mA}$	- 1.5 %	3.3	+ 1.5 %	V
Output Current	I_{O3}	$V_{O3} \times 0.9$	250	500	—	mA
Load Regulation	$\Delta V_{O3} / I_{O3}$	$I_{O3} = 1\text{ to }250\text{ mA}$	—	0.003	0.009	%/mA
Ripple Rejection	RR3	$E_{in} = 50\text{ mVrms}$, $f = 1\text{ kHz}$, $I_{O3} = 150\text{ mA}$	—	45	—	dB
Dropout Voltage	ΔV_{IO3}	$I_{O3} = 250\text{ mA}$	—	0.4	0.8	V
Output Voltage Temperature Coefficient	$\Delta V_{O3} / T_a$	$T_a = -20\text{ to }+75\text{ }^\circ\text{C}$ / $I_{O3} = 150\text{ mA}$	—	± 50	—	p-pm/ °C

7. Voltage Monitor

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Threshold Voltage (Detection)	V _{DET}	Vo2, Vo3 increasing	3.00	3.05	3.10	V
Threshold Voltage (Release)	V _{REL}	Vo2, Vo3 decreasing	3.04	3.11	3.18	V
Threshold Difference	V _{DET} - V _{REL}	—	20	60	100	mV
Threshold Voltage Temperature Coefficient	$\Delta V_{DET} / T_a$	T _a = -20 to +75 °C	—	±50	—	p-pm/°C
Delay Time 1	td1	V _{VH} = ON → V _{M1} = H	4	5	—	ms
Delay Time 2	td2	V _{M1} = H → V _{M2} = H	1	1.5	—	ms
Leak Current	I _{LEAK_VM}	V _{M1} = V _{M2} = 5 V	0	0.5	1.0	μA
Output Current	I _{OUT}	V _{M1} = V _{M2} = 0.5 V	4	7	—	mA

8. LDO 4

V_{H_IN} = 22 V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V _{VH1}	I _{VH} = 20 mA VSEL1 = L, VSEL2 = L or VSEL1 = H, VSEL2 = H	- 1.5 %	12	+ 1.5 %	V
Output Voltage	V _{VH2}	I _{VH} = 20 mA VSEL1 = H, VSEL2 = L or VSEL1 = L, VSEL2 = H	- 1.5 %	15	+ 1.5 %	V
Output Current	I _{VH}	V _{VH} × 0.9	40	85	—	mA
Load Regulation	$\Delta V_{VH} / I_{VH}$	I _{VH} = 1 to 40 mA	—	0.005	0.015	%/mA
Ripple Rejection	RR4	E _{in} = 50 mVrms, f = 1 kHz, I _{VH} = 20 mA	—	60	—	dB
Dropout Voltage	ΔV_{IVH}	I _{VH} = 40 mA	—	0.5	1.0	V
Output Voltage Temperature Coefficient	$\Delta V_{VH} / T_a$	T _a = -20 to + 75 °C / I _{VH} = 200 mA	—	±70	—	p-pm/°C
OFF period Output Resistance	R _{O_OFF4}	V _{VIN} = 0 V, V _{H_IN} = 22 V	80	150	300	Ω

9. LDO 5

V_{L_IN} = -13 V

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Output Voltage	V _{VL1}	I _{VL} = 15 mA VSEL1 = L, VSEL2 = L	- 3.0 %	- 5	+ 3.0 %	V
Output Voltage	V _{VL2}	I _{VL} = 15 mA VSEL1 = H, VSEL2 = L or VSEL1 = H, VSEL2 = H	- 3.0 %	- 7	+ 3.0 %	V
Output Voltage	V _{VL3}	I _{VL} = 15 mA VSEL1 = L, VSEL2 = H	- 3.0 %	- 7.5	+ 3.0 %	V
Output Current	I _{VL}	V _{VL} × 0.9	30	75	—	mA
Load Regulation	$\Delta V_{VL} / I_{VL}$	I _{VL} = 1 to 30 mA	—	0.01	0.02	%/mA
Ripple Rejection	RR5	E _{in} = 50 mVrms, f = 1 kHz, I _{VL} = 15 mA	—	35	—	dB
Dropout Voltage	ΔV_{IVL}	I _{VL} = 30 mA	—	0.3	0.6	V
Output Voltage Temperature Coefficient	$\Delta V_{VL} / T_a$	T _a = -20 to + 75 °C / I _{VL} = 15 mA	—	± 70	—	p-pm/°C
OFF period Output Resistance	R _{O_OFF5}	V _{VIN} = 0 V, V _{L_IN} = -13 V	100	200	400	Ω

10. Voltage Selector

VH_IN = 22 V, VL_IN = -13 V

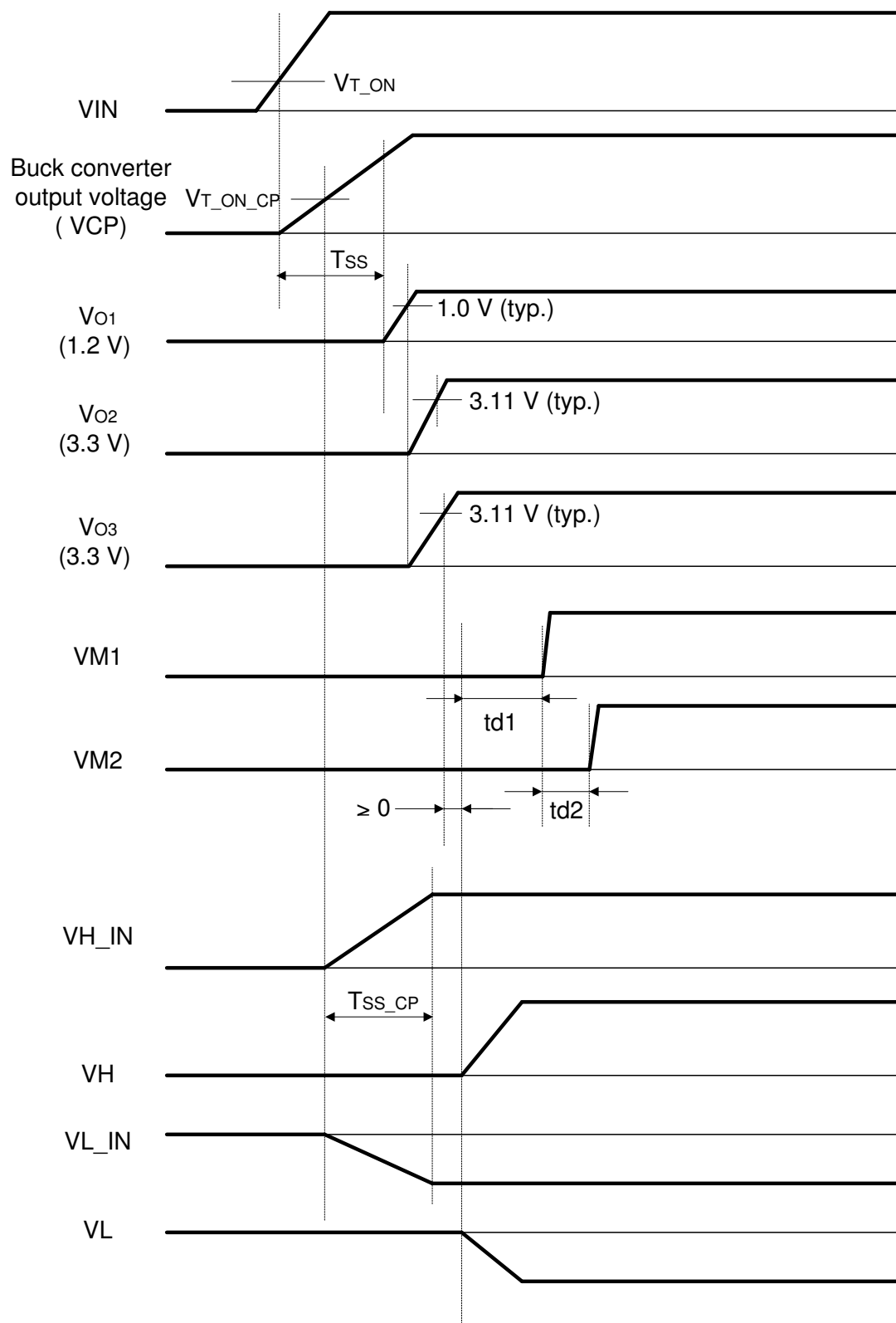
Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
VSEL1 terminal Low	VSEL1_L	—	0	—	0.5	V
VSEL1 terminal High	VSEL1_H	—	1.6	—	—	V
VSEL2 terminal Low	VSEL2_L	—	0	—	0.5	V
VSEL2 terminal High	VSEL2_H	—	1.6	—	—	V

11. VH and VL Output Voltage Settings

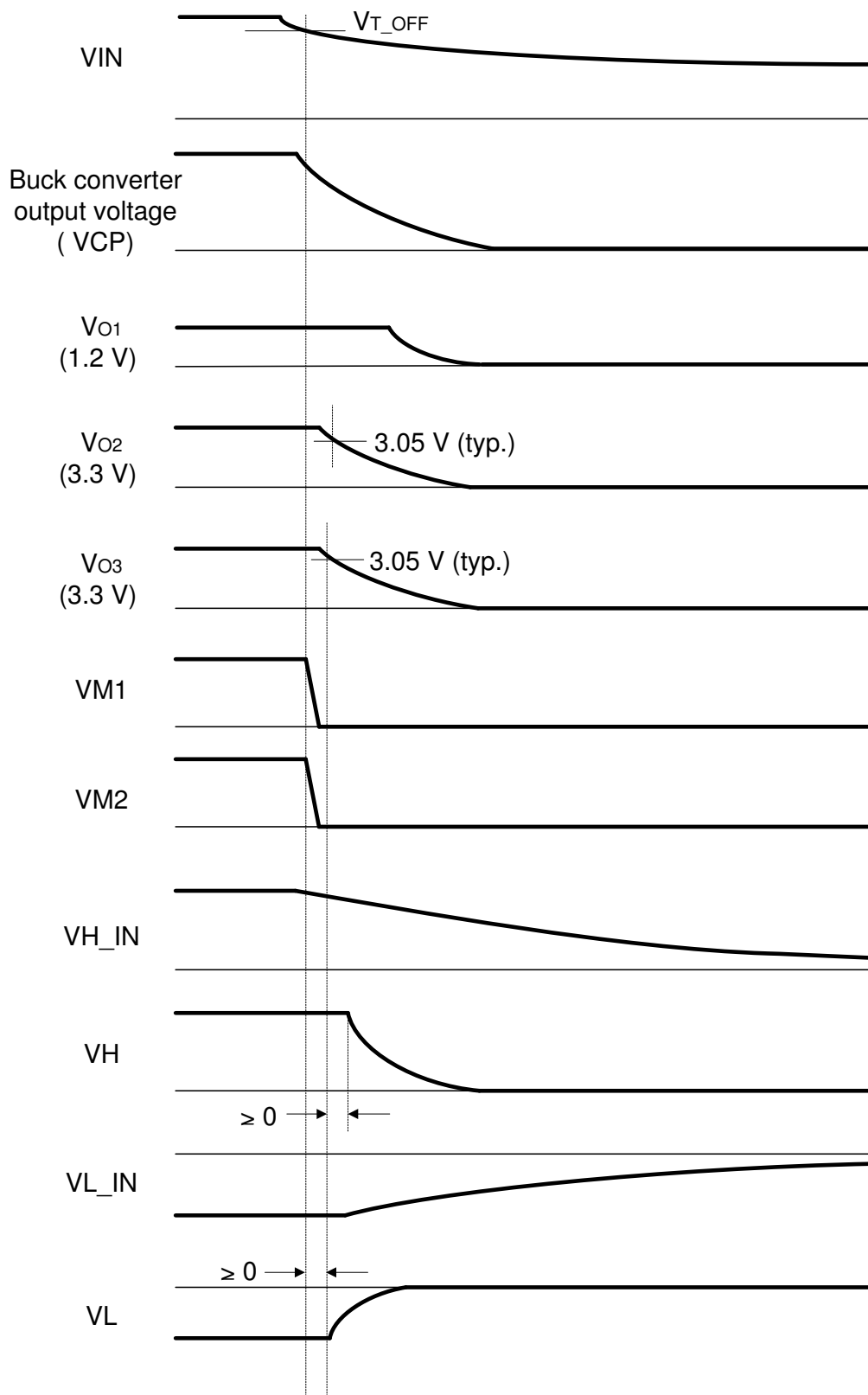
Parameter	Voltage selector settings	V _{VH}	V _{VL}	Unit
Voltage Setting 1	VSEL1 = L, VSEL2 = L	12	- 5.0	V
Voltage Setting 2	VSEL1 = H, VSEL2 = L	15	- 7.0	V
Voltage Setting 3	VSEL1 = L, VSEL2 = H	15	- 7.5	V
Voltage Setting 4	VSEL1 = H, VSEL2 = H	12	- 7.0	V

Sequence

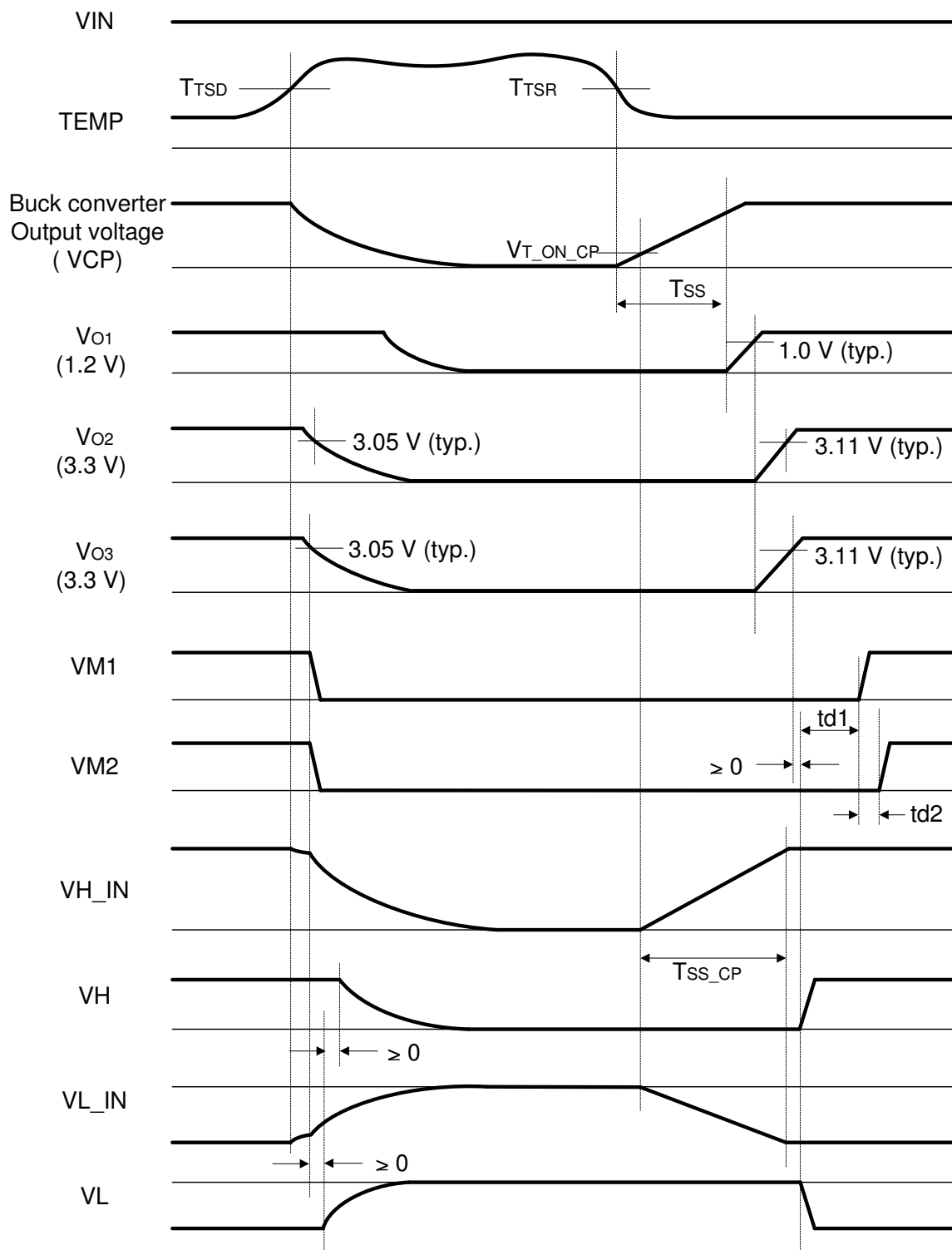
1. Start-up



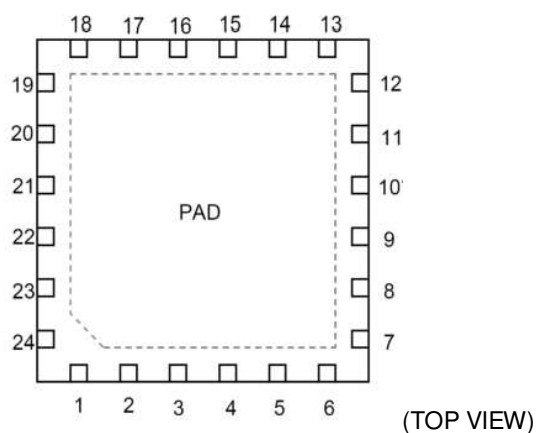
2. Stop



3. Thermal shut down and recovery



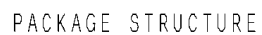
Pin Configuration



Pin Description

Pin	Symbol	Function
1	FB	Feedback Voltage
2	LDO_IN1	LDO1 Input Voltage
3	Vo1	1.2 V Output Voltage
4	Vo2	3.3 V Output Voltage for Digital circuit
5	LDO_IN2	LDO2/3 Input Voltage
6	Vo3	3.3 V Output Voltage for Analog circuit
7	VM2	Voltage Monitor Output 2 (Open Drain)
8	VM1	Voltage Monitor Output 1 (Open Drain)
9	VL	Low Voltage (- 5.0 / - 7.0 / - 7.5 V) Output
10	VL_IN	Low Voltage Input
11	GND	GND
12	VCP	Voltage Input for Charge pump
13	C2N	Charge Pump Output2 N
14	C2P	Charge Pump Output2 P
15	PGND	GND
16	C1N	Charge Pump Output1 N
17	C1P	Charge Pump Output1 P
18	VSEL1	VH/VL Output Voltage Selector 1
19	VH_IN	High Voltage Input
20	VH	High Voltage (12 V/15 V) Output
21	VIN	Supply voltage
22	NC	—
23	SW	Switch Output
24	VSEL2	VH/VL Output Voltage Selector 2
PAD	PAD	NC (PAD should be connected to GND for heat radiation.)

24PIN WQFN (PLASTIC)



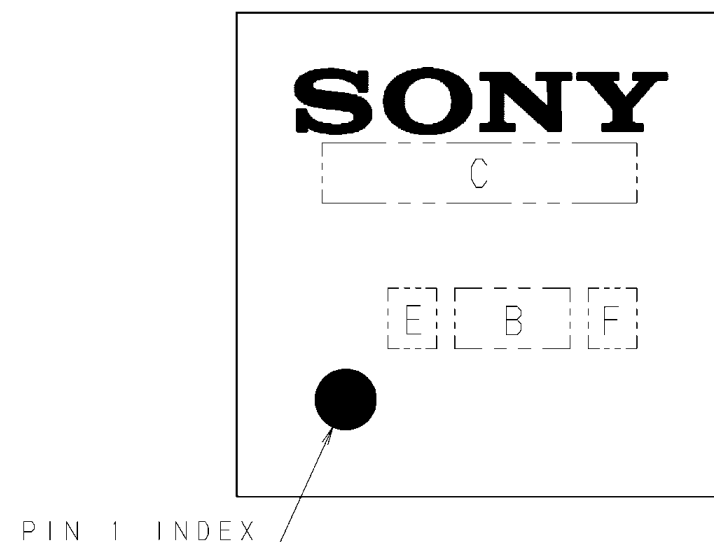
PACKAGE MATERIAL	EPOXY RESIN
TERMINAL TREATMENT	Sn-Bi
TERMINAL MATERIAL	COPPER
PACKAGE MASS	0.031g

15

Marking

WQFN-24P-091

AP-2000-M24WNH1S1



MARKING C: A3840

F:

注1) C部は製品名 (Max5文字) を配置する。

(5文字を超える場合は製品名省略標示規定に従う。)

2) B部はロット番号 (Max2文字) を配置する。

3) E部は西暦末尾 (1文字) を配置する。

4) F部は製品仕様記号 (1文字) を配置する。

< INSTRUCTIONS >

1) TYPE NO. (MAX 5 CHARACTERS) IN SECTION C.

(FOR MORE THAN 5 CHARACTERS FOLLOW RULES FOR ABBREVIATIONS.)

2) LOT NO. (MAX 2 CHARACTERS) IN SECTION B.

3) END OF A. D. NUMBER (1 CHARACTER) IN SECTION E.

4) SPECIFICATION CODE (1 CHARACTER) IN SECTION F.

Note

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Application circuits shown, if any, are typical examples illustrating the operation of the devices. Sony cannot assume responsibility for any problems arising out of the use of these circuits.